Land Use Activities Affect Groundwater Quality

Point Source and Nonpoint Source Pollution

Water quality is directly related to land use. As water moves over the land surface, it can dissolve or carry contaminants with it to ground or surface waters. Because ground and surface waters are interconnected, the quality of one can affect the quality of the other.

There are two general types of pollution – *point source pollution* and *nonpoint source pollution*. Point source pollution comes from a single point, such as discharge from a sewage treatment plant. Nonpoint source pollution is less obvious. It originates over a widespread area of the landscape rather than from a single point. Common examples of nonpoint source pollution are stormwater runoff, leaking underground storage tanks, fertilizers and pesticides, spilled motor oil, effluent from septic systems, and animal waste from pets and livestock.

In recent years, we have made progress in reducing point sources of pollution by treating industrial discharges and upgrading the treatment capabilities of sewage plants. However, nonpoint source pollution is more difficult to control and is the challenge before us.

Nonpoint Sources of Pollution and Their Effects on Groundwater

Septic systems. Thirty-five percent of Rhode Islanders rely on septic systems to treat wastewater. When sited, operated, and maintained properly, they are of little or no threat to water quality. However, failed septic systems can contribute hazardous contaminants to nearby groundwater supplies, often creating a public health risk.

Contaminants of Concern:

(1) Bacteria and Viruses – can move through ground and surface water; health concerns are gastroenteritis, hepatitis and typhus.
(2) Nitrate-Nitrogen – a form of nitrogen. The drinking water standard for Nitrate-Nitrogen is 10 milligrams per liter (mg/L). Excess nitrate-nitrogen in water supplies causes “blue baby syndrome” in infants, increases nuisance algae in coastal waters, and may also be an indicator of the presence of other dissolved contaminants.
(3) Chemical compounds – discharged into septic systems through the use or disposal of household products.

Urban runoff. Precipitation that falls on impervious surfaces (i.e., roads, parking lots and paved driveways) can dissolve or carry away pollutants as it flows over these areas. If the stormwater runoff is allowed to recharge groundwater then additional pollutants could enter drinking water supplies.

Contaminants of Concern:

(1) Nitrate-Nitrogen – see Septic Systems.
(2) Heavy metals – particularly from the use of vehicles. Many can cause significant health risks.
(3) Bacteria – see Septic Systems.
(4) Road salt – from winter road maintenance. Wells located close to major roads can have elevated sodium levels.
(5) Petroleum products – gasoline, diesel fuel, and motor oil from vehicles.

House and Garage Wastes. Many cleaning products and solvents contain moderately to highly toxic chemicals, which can be a threat to our health and groundwater. Hazardous chemical wastes poured down the drain into septic systems, on the ground, or in sewers may pollute our groundwater supplies. Although they may be disposed of in small amounts, these substances can have significant cumulative effects.

Contaminants of Concern:

(1) Motor oil (2) Battery acid (3) Paint thinner (4) Cleaners and solvents (5) Antifreeze (6) Medicines

Fertilizers. Many fertilizers contain nitrogen, which, if misused, can enter the groundwater. Over-fertilizing and over-watering a lawn or garden can cause nitrogen to leach, or seep, through the soil to the groundwater. Improperly handling these products can also cause a problem for groundwater quality. Spills should be cleaned up and not washed into storm drains.

Contaminants of Concern:

(1) Nitrate-Nitrogen – Fertilizers contain nitrogen, which, once in groundwater supplies, can cause health problems. See Septic Systems.

Pesticides. Pesticides can enter groundwater supplies by leaching through the soil. The likelihood of a pesticide leaching to the groundwater depends on the characteristics of the pesticide and the site. Pesticides can pose significant health problems to humans, pets, livestock, and wildlife if ingested. Certain pesticides may also destroy beneficial insects.

Contaminants of Concern:

Various pesticides

Underground Storage Tanks. Underground storage tanks are used to store home heating fuel, and in some cases, gasoline or other petroleum products. These tanks are located beneath the ground, where, if there is a leak, it can go undetected until the chemical enters a well, nearby surface water, or seeps below the basement of the house. Several Rhode Island communities have already experienced contaminated groundwater from leaking underground storage tanks.

Contaminants of Concern:

(1) Petroleum products.
(2) Toxic compounds such as benzene, toluene, and xylene.
(3) Additives such as organic lead compounds.

Animal Lots. As with human wastes, animal waste contains bacteria and nutrients and can contaminate nearby water supplies. Animal lots that are not properly constructed and maintained, have poor drainage, or are located where the water table is close to the surface can cause groundwater contamination. Allowing animals to graze in or directly next to a water body can also have serious impacts on water quality. Allowing animal access to your drinking water well can result in waste getting into your well.

Contaminant of Concern:

(1) Nitrate-Nitrogen – See Septic Systems
(2) Bacteria and Viruses – See Septic Systems

Abandoned Wells. Unfortunately, wells that are no longer used to supply water are often not sealed properly or are left open. An abandoned well can act as a direct "pipeline" for surface to groundwater contamination.

Contaminants:

Various, depending upon what is disposed.

Protecting Our Groundwater

Private well owners are responsible for the quality of their drinking water. There are many effective, practical steps each of us can take to reduce nonpoint source pollution to nearby groundwater supplies. Some of these steps are outlined below. In addition, the University of Rhode Island's Cooperative Extension Home*A*Syst program offers programs and information to help address your water quality concerns. For information on the Cooperative Extension's programs and publications, see **For More Information**.

Test Your Private Well

Have your well water tested annually by a certified state laboratory. This will help you ensure that your water is safe to drink. Additionally, an annual test will allow you to track any changes that occur with your water quality over time.

Survey Your Property

If you own a well, proper management of the area surrounding it can help protect it from contamination. Keep chemicals and other pollutants away from your well. Map your property and survey the activities

that occur in and around the home. Be sure that your well is properly sealed and the land around the well slopes away so that water cannot pond around the wellhead. Maintain your septic system. Inventorying and inspecting your home for potential nonpoint sources of pollution is a great first step to water quality protection.

Underground Storage Tanks

The best recommendation for an underground storage tank is to have it removed by a professional and replace it with an above ground tank placed within a concrete containment structure and covered from the elements. Routinely check the tank for leaks.

Household Hazardous Products

Use non-hazardous alternatives or the least toxic product whenever possible. Do not pour these products down the drain or toilet, on the ground, or in catch basins or storm drains. It is also important to buy only as much of a hazardous product as you will use.

Recycle Motor Oil

A single quart of motor oil can contaminate thousand of gallons of water. Always recycle your oil at a municipal recycling station.

Landscape Your Yard

Landscape your property so that grass and trees help to retain stormwater and reduce runoff. When deciding on landscape plants, consider sustainable plantings that require minimum fertilizer, pesticide and irrigation inputs. The Cooperative Extension GreenShare Program has a sustainable plant list for Rhode Island. Contact 401-874-2900 for more information.

Fertilizers and Pesticides

Make sure that the fertilizers and pesticides you apply are appropriate for your situation. Always identify your pest problem before selecting a treatment. Read labels carefully and use as little of the product as possible to meet your needs – in the case of pesticides and fertilizers, more is not better. Proper disposal of fertilizers and pesticides is critical for maintaining good water quality. Use non-toxic approaches to pest control whenever possible.

Animal Waste

Keep pets and livestock away from your drinking water well. Pick up after your pet. Properly store livestock waste away from drinking water wells and where stormwater cannot contact it and carry it away in runoff waters.

The state of Rhode Island has developed a groundwater protection strategy. In addition, many communities have developed groundwater protection plans. However, groundwater protection is too important to leave up to government agencies and water companies. Concerned citizens play a vital role in protecting groundwater by wise water use, proper waste disposal and many other routine activities. By demonstrating the groundwater model and following suggested activities, you can teach your audience the value of this resource while promoting its protection.

Glossary

Aquifer – any soil or rock formation that is capable of supplying groundwater for human use.

Artesian aquifer – an aquifer that is under a confined layer. The groundwater in an artesian aquifer is under pressure.

Cone of depression – a roughly circular area around a well where the groundwater level is lowered by pumping.

Confined aquifer – see artesian aquifer.

Confining layer – impermeable soil or rock layers that restrict water movement.

Groundwater – water in a subsurface, water-saturated layer of soil or rock.

Groundwater discharge – groundwater that flows to the ground surface. Where the water table intercepts the ground surface, i.e., at a stream or wetland.

Groundwater recharge – the replenishment of groundwater by infiltration or seepage of precipitation or surface runoff.

Induced recharge – infiltration of surface water from a water body into an adjacent aquifer caused when the cone of depression created by a pumping well captures surface water from a lake, pond or stream.

Infiltrate – to permeate something by penetrating its pores; to seep into a substance.

Nonpoint source pollution –pollution that originates over a widespread area of the landscape.

Permeable – penetrable; having pores or openings that permit water to pass through.

Permeability – the capacity of water movement through soil or rock.

Point source pollution – pollution that comes from a single point, such as a discharge pipe

Porosity – the capacity of soil or rock to hold water.

Recharge area – the overlying land that contributes water to an aquifer.

Saturated zone – a subsurface zone in which all pores in a soil or rock formation are filled with water.

Surface water – water from precipitation or snowmelt that accumulates above ground in streams and rivers, lakes, ponds, reservoirs, wetlands, and oceans.

Unconfined aquifer – an aquifer in which the water table forms the upper boundary. Susceptible to contamination from activities occurring at the land's surface.

Unsaturated zone – a soil or rock zone above the water table and extending to the land's surface in which the pore spaces are only partially filled with water.

Water table – the top of the saturated zone.

Water table aquifer – see unconfined aquifer.